LANGAN

Technical Memorandum

Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
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To: Shaun Bollers – NYSDEC

From: Jason Hayes, P.E., LEED^{AP}

Info: Bronx Point LIHTC LLC
Mimi Raygorodetsky, Julia Leung, Woo Kim - Langan

Date: March 18, 2021

Re: Remedial Design Document – Groundwater Treatment Plan
Bronx Point
575 Exterior Street
Bronx, New York
BCP Site No: C203117
Langan Project No: 170480801

This Remedial Design Document presents an in-situ treatment plan to remediate petroleum-related volatile organic compounds (VOC) and naphthalene in groundwater at the Bronx Point Brownfield Cleanup Program (BCP) site located at 575 Exterior Street (Block 2356, Lots 2, 6, and 10) in Bronx, New York (the site). This document supplements the New York State Department of Environmental Conservation (NYSDEC)-approved May 11, 2020 Remedial Action Work Plan (RAWP). The site is about 194,700 square feet in area and is a vacant, asphalt- and concrete-paved lot with one remnant steel loading structure in the western part of the site. A site location map is presented as Figure 1 and a site plan is presented as Figure 2.

The RAWP describes the following remedial measures to address petroleum-related impacts in groundwater:

- Excavation and off-site disposal of the top 2 feet of historic fill across the site and petroleum-contaminated source material at depths beyond 2 feet in select areas to the groundwater table.
    - Soil above the groundwater table containing odors, staining, elevated photoionization detector (PID) readings, and/or petroleum-related VOCs above Title 6 of the New York Codes, Rules, and Regulations (6 NYCRR) Part 375 Protection of Groundwater (PGW) Soil Cleanup Objectives (SCO) will be removed as part of the remedial action.
- Decommissioning and removal of any potential underground storage tanks (UST), if encountered, in accordance with NYSDEC Program Policy: Technical Guide for Site Investigation and Remediation (DER-10) 5.4(b)(5) - Confirmation endpoint soil samples

will be collected from the base and sidewalls of UST excavations after any petroleum-impacted soil, if identified, is excavated and removed.

- In-situ treatment of groundwater (subject of this memorandum) via temporary injection points within an area of about 43,500 square feet in the central part of the site to treat petroleum-related VOCs and naphthalene in groundwater

1.0 SITE BACKGROUND

The site is underlain by a historic fill layer predominately consisting of black, brown, and gray sand with varying amounts of clay, silt, organics, gravel, slag, brick, tar pieces, wood, glass, concrete, cobble, plastic, and shell fragments to a maximum depth of about 24 feet below grade surface (bgs). The historic fill layer is underlain by native soil consisting of varying amounts of sand, silt, and clay. Bedrock was encountered during a geotechnical investigation between 65 and 87 feet bgs. Depth to groundwater is between 5.85 and 13.05 feet bgs (corresponding to el. 0.74 feet and 1.78 feet[1], respectively). Groundwater generally flows north/northwest towards the Harlem River (western perimeter of the site), as shown in the groundwater elevation contour map presented as Figure 3.

The March 6, 2020 Remedial Investigation Report (RIR) provides a description of contaminant distribution throughout the site. Evidence of petroleum-like contamination was observed in soil and groundwater during the Remedial Investigation (RI), including petroleum-like odors in purged groundwater and staining, odors, and PID readings above background in soil between 12.5 and 16 feet bgs. Petroleum-impacted groundwater was identified in MW07 and is the focus of this memorandum. The contaminants of concern (COC) addressed by the proposed in-situ groundwater remedy are the petroleum-related VOC, 1,2,4-trimethylbenzene, and the petroleum-related SVOC, naphthalene.

The highest concentrations of 1,2,4-trimethylbenzene and naphthalene were detected at 7.57 micrograms per liter [µg/L] and 14.2 µg/L, respectively, in a groundwater sample collected from MW07, located in the central portion of the site. Groundwater sample locations and analytical results are presented in Figure 4.

Based on the lack of petroleum-related VOCs and/or naphthalene above NYSDEC SGVs in surrounding monitoring wells (MW03, MW04, MW06, MW08, MW12, and MW13), in-situ remedial treatment will be performed within an area of about 43,500 square feet centered on MW07. The target treatment depth will be from the top of the groundwater table to the bottom

[1] Datum referenced is the North American Vertical Datum of 1988 (NAVD88) which is approximately 1.1 feet above mean sea level datum at Sandy Hook, New Jersey as defined by the United States Geologic Survey (USGS NGVD 1929). Site elevations were obtained from a topographical survey prepared by Langan in December 2017.

of the screened interval of the well at MW07 (about 8 feet to 15 feet bgs below the groundwater table).

2.0 IN-SITU REMEDIATION TECHNOLOGY DESCRIPTION

2.1 Oxygen Release Compound (ORC Advanced®)

An oxygen release compound (ORC) produces a controlled release of molecular oxygen for an extended period of time. The Regenesis ORC Advanced® is a formulation of calcium oxy-hydroxide that produces a controlled release of molecular oxygen for a period of up to 12 months upon hydration. The oxygen supports microbial communities that transform petroleum hydrocarbons into benign compounds (e.g., carbon dioxide and water). The application of ORC Advanced® to the subsurface can enhance biological activity, which accelerates the rate of naturally-occurring aerobic biodegradation in groundwater. Attachment 1 includes the Safety Data Sheets (SDS) and a product sheet for the selected product.

2.2 Remedy Selection and Implementation

Source Removal, Backfill, and Injections of ORC Advanced®

Soil above the groundwater table containing odors, staining, elevated PID readings, and/or petroleum-related VOCs above PGW SCOs (i.e., source material) will be removed as part of the remedial action. Over-excavated areas will be backfilled with clean fill meeting the lower of PGW and RURR SCOs. Following excavation and removal of source material and backfill with clean fill, about 7,200 pounds of ORC Advanced® will be mixed with water and applied via 90 temporary direct-push injection points to depths between 15 and 23 feet bgs within the treatment area as a polishing measure. The radius of treatment around each injection point is estimated to be about 10 feet.

Temporary injection points will be installed in two zones (Zone 1 and Zone 2), with the higher aerial frequency of injection points in the zone around MW07 (Zone 1) and lower frequency of injection points in the zone farther to MW07 (Zone 2). Each zone is defined as follows:

Zone	Distance from MW07 (feet)	No. of Injection Points	Spacing (feet)
1	0 to 40	25	15
2	40 to 205	65	20 (north-south) & 30 (east-west)

A flexible hose will extend from a mixing tank to an injection pump, and then to an injection manifold at direct push locations. The injection record shall include the rate, pressure, volume,

and injection depth at each location. The groundwater treatment area and proposed injection point locations are shown on Figure 5. Application recommendations are included as Attachment 2.

3.0 MONITORING

Monitoring will consist of baseline (RI groundwater data), post-injection, and confirmation groundwater sampling at the location of monitoring well MW07 (see Figure 5).

Monitoring at MW07 will include collection of one groundwater sample for NYSDEC Part 375 VOCs via United States Environmental Protection Agency (USEPA) method 8260C and naphthalene via USEPA method 8270D. A duplicate, field blank, and trip blank sample will also be analyzed during each sampling event. Geochemical parameters (e.g., dissolved oxygen [DO], oxidation-reduction potential [ORP], specific conductivity, pH, temperature, turbidity) will be recorded during each sampling event

The first post-injection monitoring event will be performed about two weeks after completion of the ORC Advanced® injections, and quarterly (3 months later) thereafter for one year. If monitoring well MW07 is destroyed during construction activities, MW07 will be re-installed in accordance with the procedures outlined in the April 10, 2019 Remedial Investigation Work Plan (RIWP). Monitoring activities may be discontinued before one year if there are two or more successive events with petroleum-related VOCs and naphthalene below the NYSDEC SGVs in groundwater. Monitoring will not be discontinued without written approval from the NYSDEC.

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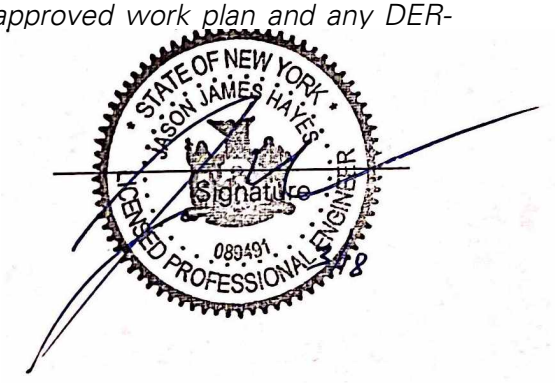
4.0 CERTIFICATION

I, Jason Hayes, PE, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Technical Memorandum was prepared in accordance with all applicable statutes and regulations and in substantial conformance with DER-10 and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

JASON HAYES
NYS Professional Engineer 089491

3/18/2021
Date



Attachments

Attachment 1: SDS and Product Sheet
Attachment 2: Regenesis Application Recommendations

Figures

Figure 1: Site Location Map
Figure 2: Site Plan
Figure 3: Groundwater Elevation Contour Map
Figure 4: Groundwater Sample Location and Analytical Results Map
Figure 5: Treatment Area Location Plan

FIGURES

MAP REFERENCE: USGS 7.5 MINUTE CENTRAL PARK NY-NJ TOPOGRAPHIC QUADRANGLE, DATED 2016

APPROXIMATE SITE BOUNDARY

LANGAN

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Project	BRONX POINT BLOCK No. 2356, LOT Nos. 2, 6, 10 BRONX NEW YORK
Figure Title	SITE LOCATION MAP
Project No.	170480801
Date	10/26/2020
Drawn By	KW
Checked By	WK
Figure No.	1

Filename: \\langan.com\data\NYC\data8\170480801\Cadd Data - 170480801\2D-DesignFiles\Environmental\Treatability Memo\Figure 1 - Site Location Map.dwg Date: 11/18/2020 Time: 11:03 User: rbalkind Style Table: Langan.stb Layout: ANSIA-BP

LEGEND:

APPROXIMATE SITE BOUNDARY

PROPOSED BUILDING FOOTPRINTS

NOTES:

1. BASEMAP SOURCE: SURVEY PREPARED BY LANGAN DATED OCTOBER 20, 2017.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. NORTH ARROW SHOWS TRUE NORTH.

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

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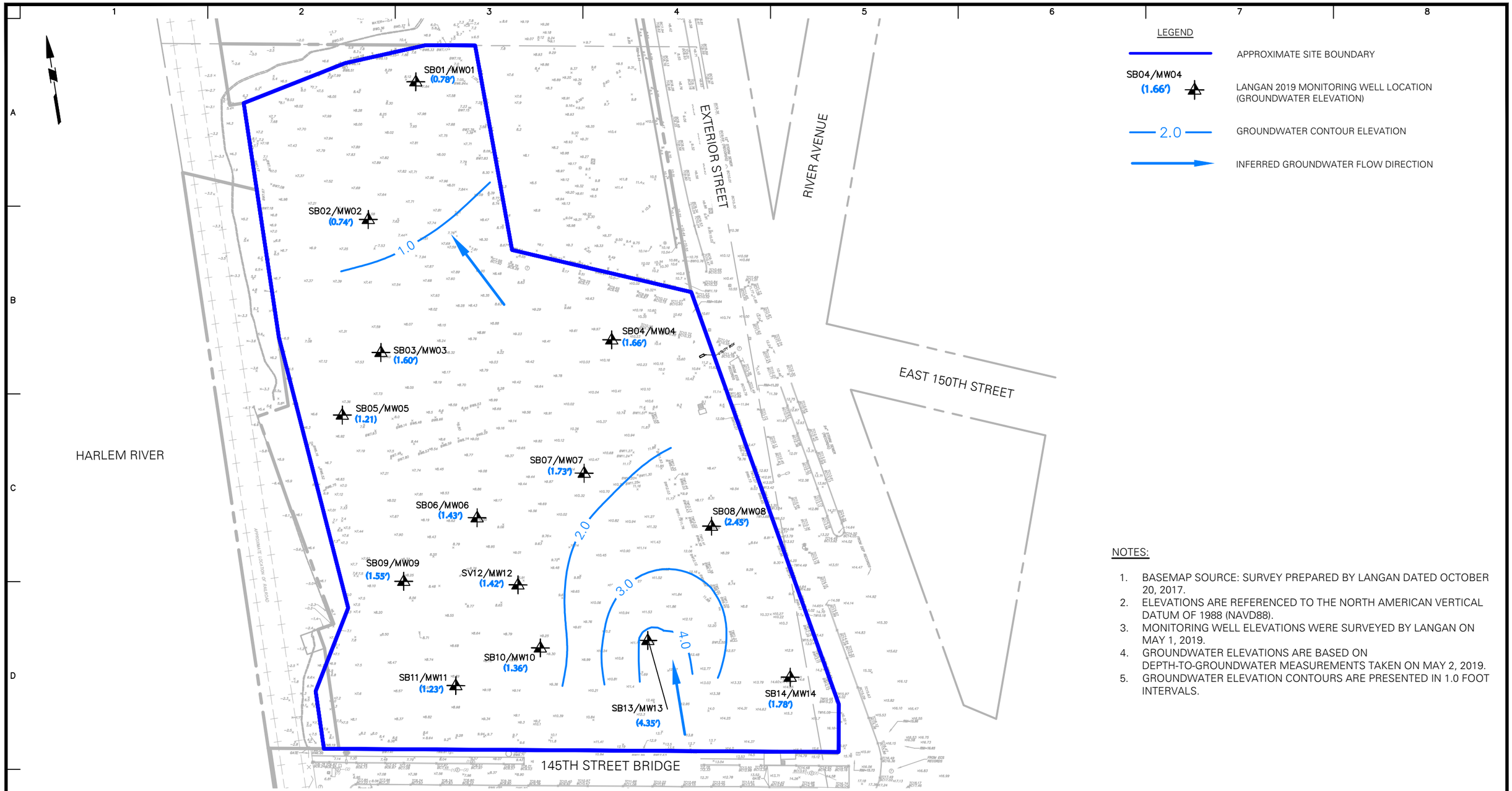
Project: BRONX POINT
BLOCK No. 2356, LOT Nos. 2, 6, 10
BRONX NEW YORK

Figure Title: SITE PLAN

Project No. 170480801
Date 06/11/2019
Drawn By KW
Checked By WK

Figure No. 2

Filename: \\langan.com\data\NYC\data8\170480801\Cadd Data - 170480801\2D-DesignFiles\Environmental\Treatability Memo\Figure 2 - Site Plan.dwg Date: 11/18/2020 Time: 11:05 User: rbalkind Style Table: Langan.stb Layout: Site Plan



NOTES:

1. BASEMAP SOURCE: SURVEY PREPARED BY LANGAN DATED OCTOBER 20, 2017.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. MONITORING WELL ELEVATIONS WERE SURVEYED BY LANGAN ON MAY 1, 2019.
4. GROUNDWATER ELEVATIONS ARE BASED ON DEPTH-TO-GROUNDWATER MEASUREMENTS TAKEN ON MAY 2, 2019.
5. GROUNDWATER ELEVATION CONTOURS ARE PRESENTED IN 1.0 FOOT INTERVALS.

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

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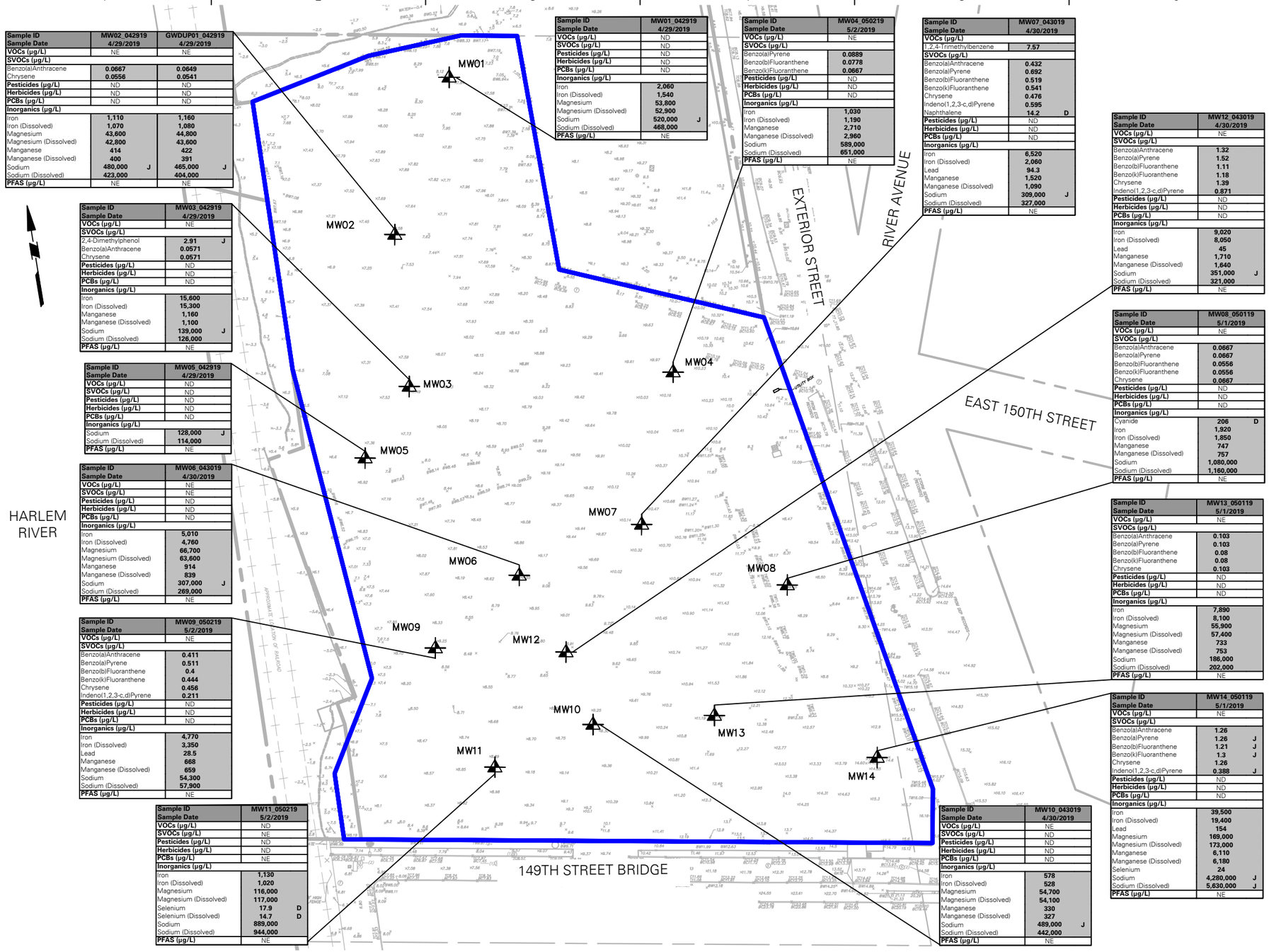
Project	BRONX POINT
	BLOCK No. 2356, LOT Nos. 2, 6, 10
	BRONX NEW YORK
Figure Title	GROUNDWATER ELEVATION CONTOUR MAP
Project No.	170480801
Date	05/23/2019
Drawn By	RB
Checked By	JL
Figure No.	3

Filename: \\langan.com\data\NYC\data8\170480801\Cadd Data - 170480801\2D-DesignFiles\Environmental\Treatability Memo\Figure 3 - Groundwater Elevation Contour Map.dwg Date: 11/18/2020 Time: 11:09 User: rbalkind Style Table: Langan.stb Layout: ANSIB-BL



Sample ID	MW02_042919
Sample Date	4/29/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(a)Anthracene	0.0667
Chrysene	0.0556
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	1,110
Iron (Dissolved)	1,070
Magnesium	43,600
Magnesium (Dissolved)	42,800
Manganese	414
Manganese (Dissolved)	400
Sodium	480,000 J
Sodium (Dissolved)	423,000
PFAS (µg/L)	NE

Sample ID	GWDUP01_042919
Sample Date	4/29/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(a)Anthracene	0.0649
Chrysene	0.0541
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	1,160
Iron (Dissolved)	1,080
Magnesium	44,800
Magnesium (Dissolved)	43,600
Manganese	422
Manganese (Dissolved)	391
Sodium	465,000 J
Sodium (Dissolved)	404,000
PFAS (µg/L)	NE

Sample ID	MW03_042919
Sample Date	4/29/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	
2,4-Dimethylphenol	2.91 J
Benzo(a)Anthracene	0.0571
Chrysene	0.0571
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	15,600
Iron (Dissolved)	15,300
Manganese	1,160
Manganese (Dissolved)	1,100
Sodium	139,000 J
Sodium (Dissolved)	126,000
PFAS (µg/L)	NE

Sample ID	MW05_042919
Sample Date	4/29/2019
VOCs (µg/L)	ND
SVOCs (µg/L)	ND
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Sodium	128,000 J
Sodium (Dissolved)	114,000
PFAS (µg/L)	NE

Sample ID	MW06_043019
Sample Date	4/30/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	NE
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	5,010
Iron (Dissolved)	4,760
Magnesium	66,700
Magnesium (Dissolved)	63,600
Manganese	914
Manganese (Dissolved)	839
Sodium	307,000 J
Sodium (Dissolved)	269,000
PFAS (µg/L)	NE

Sample ID	MW09_050219
Sample Date	5/2/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(a)Anthracene	0.411
Benzo(a)Pyrene	0.511
Benzo(b)Fluoranthene	0.4
Benzo(k)Fluoranthene	0.444
Chrysene	0.456
Indeno(1,2,3-c,d)Pyrene	0.211
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	4,770
Iron (Dissolved)	3,350
Lead	28.5
Manganese	668
Manganese (Dissolved)	659
Sodium	54,300
Sodium (Dissolved)	57,900
PFAS (µg/L)	NE

Sample ID	MW11_050219
Sample Date	5/2/2019
VOCs (µg/L)	ND
SVOCs (µg/L)	NE
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	NE
Inorganics (µg/L)	
Iron	1,130
Iron (Dissolved)	1,020
Magnesium	116,000
Magnesium (Dissolved)	117,000
Selenium	17.9 D
Selenium (Dissolved)	14.7 D
Sodium	889,000
Sodium (Dissolved)	944,000
PFAS (µg/L)	NE

Sample ID	MW01_042919
Sample Date	4/29/2019
VOCs (µg/L)	ND
SVOCs (µg/L)	ND
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	2,060
Iron (Dissolved)	1,540
Magnesium	53,800
Magnesium (Dissolved)	52,900
Sodium	520,000 J
Sodium (Dissolved)	468,000
PFAS (µg/L)	NE

Sample ID	MW04_050219
Sample Date	5/2/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(a)Pyrene	0.0889
Benzo(b)Fluoranthene	0.0778
Benzo(k)Fluoranthene	0.0667
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	1,030
Iron (Dissolved)	1,190
Manganese	2,710
Manganese (Dissolved)	2,960
Sodium	589,000
Sodium (Dissolved)	651,000
PFAS (µg/L)	NE

Sample ID	MW07_043019
Sample Date	4/30/2019
VOCs (µg/L)	
1,2,4-Trimethylbenzene	7.57
SVOCs (µg/L)	
Benzo(a)Anthracene	0.432
Benzo(a)Pyrene	0.692
Benzo(b)Fluoranthene	0.519
Benzo(k)Fluoranthene	0.541
Chrysene	0.476
Indeno(1,2,3-c,d)Pyrene	0.595
Naphthalene	14.2 D
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	6,520
Iron (Dissolved)	2,060
Lead	94.3
Manganese	1,520
Manganese (Dissolved)	1,090
Sodium	309,000 J
Sodium (Dissolved)	327,000
PFAS (µg/L)	NE

Sample ID	MW12_043019
Sample Date	4/30/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(a)Anthracene	1.32
Benzo(a)Pyrene	1.52
Benzo(b)Fluoranthene	1.11
Benzo(k)Fluoranthene	1.18
Chrysene	1.39
Indeno(1,2,3-c,d)Pyrene	0.871
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	9,020
Iron (Dissolved)	8,050
Lead	45
Manganese	1,710
Manganese (Dissolved)	1,640
Sodium	351,000 J
Sodium (Dissolved)	321,000
PFAS (µg/L)	NE

Sample ID	MW08_050119
Sample Date	5/1/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(a)Anthracene	0.0667
Benzo(a)Pyrene	0.0667
Benzo(b)Fluoranthene	0.0556
Benzo(k)Fluoranthene	0.0556
Chrysene	0.0667
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Cyanide	206 D
Iron	1,920
Iron (Dissolved)	1,850
Manganese	747
Manganese (Dissolved)	757
Sodium	1,080,000
Sodium (Dissolved)	1,160,000
PFAS (µg/L)	NE

Sample ID	MW13_050119
Sample Date	5/1/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(a)Anthracene	0.103
Benzo(a)Pyrene	0.103
Benzo(b)Fluoranthene	0.08
Benzo(k)Fluoranthene	0.08
Chrysene	0.103
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	7,890
Iron (Dissolved)	8,100
Magnesium	55,900
Magnesium (Dissolved)	57,400
Manganese	733
Manganese (Dissolved)	752
Sodium	186,000
Sodium (Dissolved)	202,000
PFAS (µg/L)	NE

Sample ID	MW14_050119
Sample Date	5/1/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(a)Anthracene	1.26
Benzo(a)Pyrene	1.26 J
Benzo(b)Fluoranthene	1.21 J
Benzo(k)Fluoranthene	1.3 J
Chrysene	1.26
Indeno(1,2,3-c,d)Pyrene	0.388 J
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	39,500
Iron (Dissolved)	19,400
Lead	154
Magnesium	169,000
Magnesium (Dissolved)	173,000
Manganese	6,110
Manganese (Dissolved)	6,180
Selenium	24
Sodium	4,280,000 J
Sodium (Dissolved)	5,630,000 J
PFAS (µg/L)	NE

Sample ID	MW10_043019
Sample Date	4/30/2019
VOCs (µg/L)	NE
SVOCs (µg/L)	ND
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	578
Iron (Dissolved)	528
Magnesium	54,700
Magnesium (Dissolved)	54,100
Manganese	330
Manganese (Dissolved)	327
Sodium	489,000 J
Sodium (Dissolved)	442,000
PFAS (µg/L)	NE

LEGEND

APPROXIMATE SITE BOUNDARY

MW04 RI MONITORING WELL LOCATION (LANGAN 2019)

Analyte	NYSDEC SGVs
VOCs (µg/L)	
1,2,4-Trimethylbenzene	5
SVOCs (µg/L)	
2,4-Dimethylphenol	1
Benzo(a)Anthracene	0.002
Benzo(a)Pyrene	0
Benzo(b)Fluoranthene	0.002
Benzo(k)Fluoranthene	0.002
Chrysene	0.002
Indeno(1,2,3-c,d)Pyrene	0.002
Naphthalene	10
Metals (µg/L)	
Cyanide	200
Iron	300
Lead	25
Magnesium	35,000
Manganese	300
Selenium	10
Sodium	20,000

NOTES:

1. BASEMAP SOURCE: SURVEY PREPARED BY LANGAN DATED OCTOBER 20, 2017.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. GROUNDWATER ANALYTICAL RESULTS ARE COMPARED TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TITLE 6 OF THE OFFICIAL COMPILATION OF NEW YORK CODES, RULES, AND REGULATIONS (NYCRR) TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1 AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES FOR CLASS GA WATER (NYSDEC SGVS).
4. ANALYTES DETECTED ABOVE THE NYSDEC SGVS ARE BOLDED AND SHADED.
5. VOC = VOLATILE ORGANIC COMPOUND
6. SVOC = SEMIVOLATILE ORGANIC COMPOUND
7. PFAS = PER- AND POLYFLUOROALKYL SUBSTANCES
8. ug/L = MICROGRAMS PER LITER
9. ND = NOT DETECTED
10. NE = NOT EXCEEDED
11. D = THE CONCENTRATION REPORTED IS A RESULT OF A DILUTED SAMPLE
12. J = THE ANALYTE WAS DETECTED ABOVE THE METHOD DETECTION LIMIT (MDL), BUT BELOW THE REPORTING LIMIT (RL); THEREFORE, THE RESULT IS AN ESTIMATED CONCENTRATION.
13. RI = REMEDIAL INVESTIGATION

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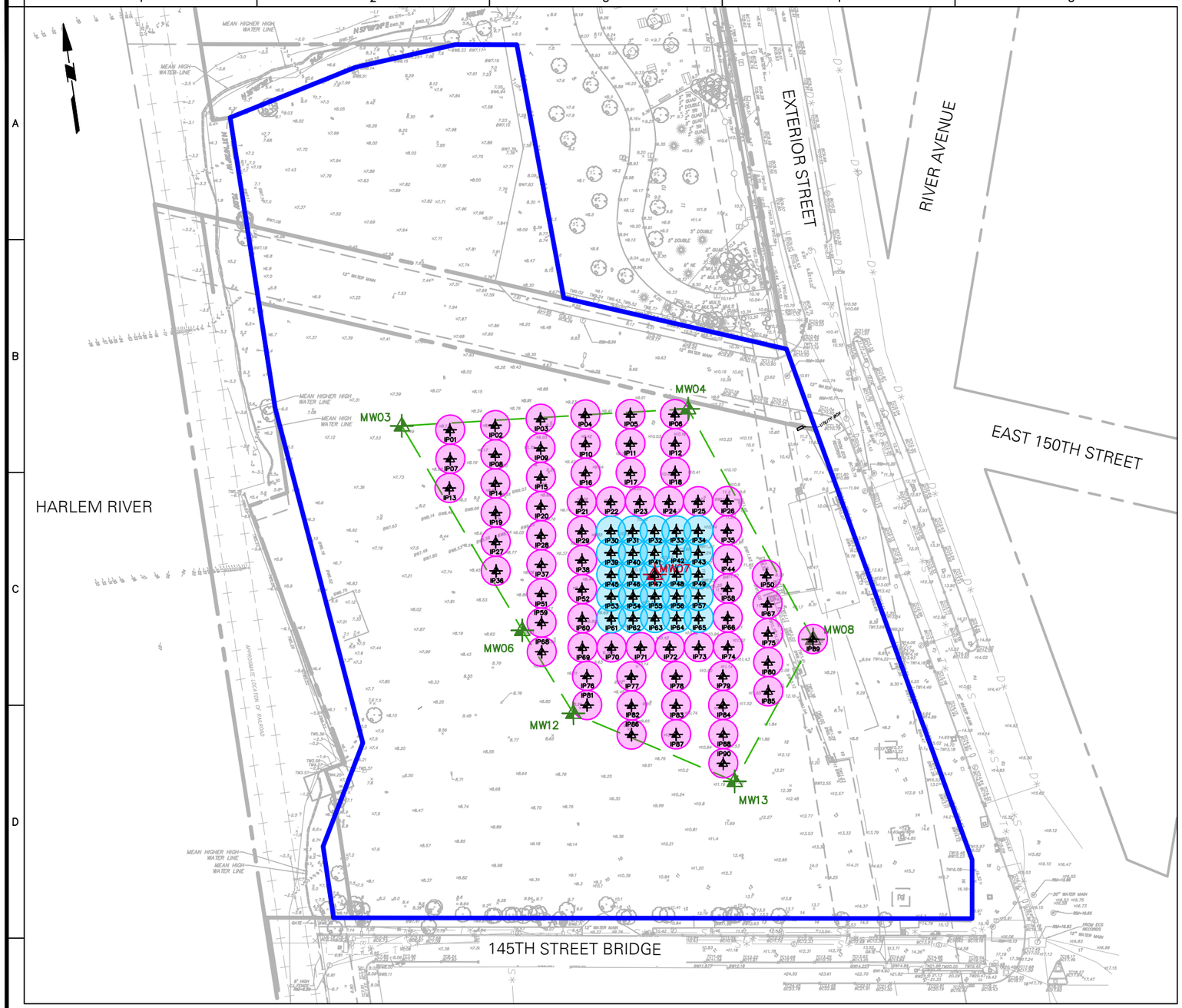
Project
BRONX POINT
BLOCK No. 2356, LOT Nos. 2, 6, 10
BRONX NEW YORK

Figure Title
GROUNDWATER SAMPLE LOCATION AND ANALYTICAL RESULTS MAP

Project No. 170480801
Date 10/27/2020
Drawn By KW
Checked By WK

Figure No. 4

Filename: \\langan.com\data\NYC\data8\170480801\Cadd Data - 170480801\2D-DesignFiles\Environmental\Treatability Memo\Figure 4 - Groundwater Sample Location and Analytical Results Map.dwg Date: 11/18/2020 Time: 11:07 User: rbalkind Style Table: Langan.stb Layout: ANSIB-BL



LEGEND:

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE AREA OF ORC® ADVANCED APPLICATION VIA INJECTION POINTS
- IP01 — PROPOSED TEMPORARY DIRECT PUSH INJECTION POINT LOCATION
- APPROXIMATE ZONE 1 RADIUS OF INFLUENCE (10-FT RADIUS; 15-FT SPACING)
- APPROXIMATE ZONE 2 RADIUS OF INFLUENCE (10-FT RADIUS; 20-FT SPACING)
- MW07 — APPROXIMATE MONITORING WELL LOCATION WITH PETROLEUM-RELATED COMPOUNDS EXCEEDING THE NYSDEC SGVs (LANGAN 2019 REMEDIAL INVESTIGATION)
- MW03 — APPROXIMATE MONITORING WELL LOCATIONS WITH NO PETROLEUM-RELATED COMPOUNDS EXCEEDING THE NYSDEC SGVs (LANGAN 2019 REMEDIAL INVESTIGATION)

NOTES:

1. BASEMAP SOURCE: SURVEY PREPARED BY LANGAN DATED OCTOBER 20, 2017.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. NORTH ARROW SHOWS TRUE NORTH.
4. 1,2,4-TRIMETHYLBENZENE AND NAPTHALENE WERE DETECTED ABOVE THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TITLE 6 OF THE OFFICIAL COMPILATION OF NEW YORK CODES, RULES, AND REGULATIONS (NYCRR) TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1 AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES FOR CLASS GA WATER (NYSDEC SGVs) IN MONITORING WELL MW07 DURING THE REMEDIAL INVESTIGATION (RI).
5. FT = FOOT
6. ORC® = OXYGEN RELEASE COMPOUND

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

80 0 40 80
SCALE IN FEET

LANGAN
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New York, NY 10001
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Project: BRONX POINT
BLOCK No. 2356, LOT Nos. 2, 6, 10
BRONX NEW YORK

Figure Title: TREATMENT AREA LOCATION PLAN

Project No. 170480801
Date 11/13/2020
Drawn By LE
Checked By WK

Figure No. 5

Filename: \\langan.com\data\NYC\data8\170480801\Cadd Data - 170480801\2D-DesignFiles\Environmental\Treatability Memo\Figure 5 - Treatment Area Location Map v2.dwg Date: 12/17/2020 Time: 16:16 User: rbalkind Style Table: Langan.stb Layout: Site Plan

ATTACHMENT 1

SAFETY DATA AND PRODUCT SHEET

LANGAN

SAFETY DATA SHEET

1. Identification

Product identifier	**Oxygen Release Compound Advanced (ORC Advanced®)**
Other means of identification	None.
Recommended use	Soil and Groundwater Remediation.
Recommended restrictions	None known.

Manufacturer/Importer/Supplier/Distributor information

Company name	Regenesis
Address	1011 Calle Sombra San Clemente, CA 92673 USA
General information	949-366-8000
E-mail	CustomerService@regenesis.com

Emergency phone number	For Hazardous Materials Incidents ONLY (spill, leak, fire, exposure or accident), call CHEMTREC 24/7 at:
USA, Canada, Mexico	(+)1-800-424-9300
International	(+)1-703-527-3887

2. Hazard identification

Physical hazards	Oxidising solids	Category 2
Health hazards	Skin corrosion/irritation	Category 2
	Serious eye damage/eye irritation	Category 1
	Specific target organ toxicity following single exposure	Category 3 respiratory tract irritation

Label elements

Signal word	Danger
Hazard statement	May intensify fire; oxidiser. Causes skin irritation. Causes serious eye damage. May cause respiratory irritation.

Precautionary statement

Prevention	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Keep away from clothing and other combustible materials. Avoid breathing dust. Wash thoroughly after handling. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection.
Response	IF ON SKIN: Wash with plenty of water. IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTRE/doctor. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash it before reuse. In case of fire: Use appropriate media to extinguish.
Storage	Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Other hazards	None known.
Supplemental information	None.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Calcium peroxide		1305-79-9	≥75
Calcium hydroxide		1305-62-0	≤25
Dipotassium Phosphate		7758-11-4	<5
Monopotassium Phosphate		7778-77-0	<5

Composition comments All concentrations are in percent by weight unless otherwise indicated.

4. First-aid measures

Inhalation Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTRE or doctor/physician if you feel unwell.

Skin contact IF ON CLOTHING: rinse immediately contaminated clothing and skin with plenty of water before removing clothes. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

Eye contact Do not rub eyes. Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention immediately.

Ingestion Never give anything by mouth to a victim who is unconscious or is having convulsions. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical attention if symptoms occur.

Most important symptoms/effects, acute and delayed Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Dusts may irritate the respiratory tract, skin and eyes. Skin irritation. May cause redness and pain.

Indication of immediate medical attention and special treatment needed Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.

General information Take off all contaminated clothing immediately. Contact with combustible material may cause fire. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Wash contaminated clothing before reuse.

5. Fire-fighting measures

Suitable extinguishing media Water spray, fog (flooding amounts). Foam. Dry chemical powder. Carbon dioxide (CO2).

Unsuitable extinguishing media None known.

Specific hazards arising from the chemical Greatly increases the burning rate of combustible materials. Containers may explode when heated. During fire, gases hazardous to health may be formed. Combustion products may include: metal oxides.

Special protective equipment and precautions for firefighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Fire fighting equipment/instructions In case of fire and/or explosion do not breathe fumes. Move containers from fire area if you can do so without risk. Use water spray to cool unopened containers.

Specific methods Cool containers exposed to flames with water until well after the fire is out.

General fire hazards May intensify fire; oxidiser. Contact with combustible material may cause fire.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep away from clothing and other combustible materials. Wear appropriate protective equipment and clothing during clean-up. Use a NIOSH/MSHA approved respirator if there is a risk of exposure to dust/fume at levels exceeding the exposure limits. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up

Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Collect dust using a vacuum cleaner equipped with HEPA filter. Keep combustibles (wood, paper, oil etc) away from spilled material. Ventilate the contaminated area. Stop the flow of material, if this is without risk. Absorb in vermiculite, dry sand or earth and place into containers.

Large Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal. Shovel the material into waste container. Minimise dust generation and accumulation. Avoid the generation of dusts during clean-up. Following product recovery, flush area with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.

Never return spills to original containers for re-use. Place all material into loosely covered plastic containers for later disposal. For waste disposal, see section 13 of the SDS. Wear appropriate protective equipment and clothing during clean-up.

Environmental precautions

Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling

Minimise dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Keep away from heat. Provide appropriate exhaust ventilation at places where dust is formed. Keep away from clothing and other combustible materials. Take any precaution to avoid mixing with combustibles. Avoid contact with water and moisture. Do not get this material in contact with eyes. Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.

Conditions for safe storage, including any incompatibilities

Keep away from heat. Store in a cool, dry place out of direct sunlight. Store in original tightly closed container. Keep container tightly closed. Store in a well-ventilated place. Do not store near combustible materials. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. Quebec OELs. (Ministry of Labor - Regulation respecting occupational health and safety)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	TWA	5 mg/m3

Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21)

Components	Type	Value
Calcium hydroxide (CAS 1305-62-0)	15 minute	10 mg/m3
	8 hour	5 mg/m3

Biological limit values No biological exposure limits noted for the ingredient(s).

Appropriate engineering controls Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. If engineering measures are not sufficient to maintain concentrations of dust particulates below the OEL (occupational exposure limit), suitable respiratory protection must be worn. If material is ground, cut, or used in any operation which may generate dusts, use appropriate local exhaust ventilation to keep exposures below the recommended exposure limits. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection Use dust-tight, unvented chemical safety goggles when there is potential for eye contact.

Skin protection

Hand protection Wear appropriate chemical resistant gloves. Frequent change is advisable. Recommended gloves include rubber, neoprene, nitrile or viton.

Other Wear appropriate chemical resistant clothing.

Respiratory protection If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn. Recommended use: Wear respirator with dust filter.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Keep from contact with clothing and other combustible materials. Remove and wash contaminated clothing promptly. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Solid.

Form Powder.

Colour White to pale yellow.

Odour Odourless.

Odour threshold Not available.

pH 12.5 (3% suspension/water)

Melting point/freezing point Not available.

Initial boiling point and boiling range Not available.

Flash point Not available.

Evaporation rate Not available.

Flammability (solid, gas) Oxidizer.

Upper/lower flammability or explosive limits

Flammability limit - lower (%) Not available.

Flammability limit - upper (%) Not available.

Explosive limit - lower (%) Not available.

Explosive limit – upper (%) Not available.

Vapour pressure Not available.

Vapour density Not available.

Relative density Not available.

Solubility(ies)

Solubility (water)	Slightly soluble
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	275 °C (527 °F)
Viscosity	Not available.

Other information

Bulk density	0.5 - 0.9 g/ml
Explosive limit	Non-explosive.

10. Stability and reactivity

Reactivity	Greatly increases the burning rate of combustible materials.
Chemical stability	Decomposes on heating. Product may be unstable at temperatures above: 275°C/527°F.
Possibility of hazardous reactions	Reacts slowly with water.
Conditions to avoid	Heat. Moisture. Avoid temperatures exceeding the decomposition temperature. Contact with incompatible materials.
Incompatible materials	Acids. Bases. Salts of heavy metals. Reducing Agents. Combustible material.
Hazardous decomposition products	Oxygen. Hydrogen peroxide (H2O2). Steam. Heat.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Dust may irritate respiratory system. Prolonged inhalation may be harmful.
Skin contact	Causes skin irritation.
Eye contact	Causes serious eye damage.
Ingestion	Ingestion may cause irritation and malaise.
Symptoms related to the physical, chemical and toxicological characteristics	Severe eye irritation. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Dusts may irritate the respiratory tract, skin and eyes. Skin irritation. May cause redness and pain.

Information on toxicological effects

Acute toxicity

Components	Species	Test Results
Calcium hydroxide (CAS 1305-62-0)		
Acute		
Oral		
LD50	Rat	7340 mg/kg
Dipotassium Phosphate (CAS 7758-11-4)		
Acute		
Oral		
LD50	Rat	> 2000 mg/kg

Skin corrosion/irritation	Causes skin irritation.
Serious eye damage/eye irritation	Causes serious eye damage.

Respiratory or skin sensitisation

Canada - Alberta OELs: Irritant

Calcium hydroxide (CAS 1305-62-0)	Irritant

Respiratory sensitisation	Not a respiratory sensitiser.
Skin sensitisation	This product is not expected to cause skin sensitisation.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	May cause respiratory irritation.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Due to the physical form of the product it is not expected to be an aspiration hazard.
Chronic effects	Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Components		Species	Test Results
Dipotassium Phosphate (CAS 7758-11-4)			
Aquatic			
Acute			
Algae	EC50	Pseudokirchneriella subcapitata	> 100 mg/l, 72 Hours
Crustacea	EC50	Daphnia magna	118.9 mg/l, 48 Hours
Fish	LC50	Oryzias latipes	> 100 mg/l, 96 Hours

Persistence and degradability	Decomposes in the presence of water. The product contains inorganic compounds which are not biodegradable.
Bioaccumulative potential	The product does not contain any substances expected to be bioaccumulating.
Mobility in soil	This substance has very low solubility in water and low mobility in the environment.
Other adverse effects	None known.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

TDG

UN number	UN1457
UN proper shipping name	CALCIUM PEROXIDE
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	II
Environmental hazards	No
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IATA

UN number	UN1457
UN proper shipping name	Calcium peroxide
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	II
Environmental hazards	No
ERG Code	5L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

UN number	UN1457
UN proper shipping name	CALCIUM PEROXIDE
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Packing group	II
Environmental hazards	
Marine pollutant	No
EmS	F-G, S-Q
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

15. Regulatory information

Canadian regulations

Controlled Drugs and Substances Act

Not regulated.

Export Control List (CEPA 1999, Schedule 3)

Not listed.

Greenhouse Gases

Not listed.

Precursor Control Regulations

Not regulated.

International regulations

Stockholm Convention

Not applicable.

Rotterdam Convention

Not applicable.

Kyoto Protocol

Not applicable.

Montreal Protocol

Not applicable.

Basel Convention

Calcium peroxide (CAS 1305-79-9)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
Taiwan	Taiwan Chemical Substance Inventory (TCSI)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information

Issue date	12-October-2015
Revision date	09-January-2019
Version No.	02
Disclaimer	Regenesis cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The information in the sheet was written based on the best knowledge and experience currently available.

OXYGEN RELEASE COMPOUND

ORC Advanced® Technical Description

ORC Advanced® is an engineered, oxygen release compound designed specifically for enhanced, *in situ* aerobic bioremediation of petroleum hydrocarbons in groundwater and saturated soils. Upon contact with groundwater, this calcium oxyhydroxide-based material becomes hydrated producing a controlled release of molecular oxygen (17% by weight) for periods of up to 12 months on a single application.

Example of ORC Advanced

ORC Advanced decreases time to site closure and accelerates degradation rates up to 100 times faster than natural degradation rates. A single ORC Advanced application can support aerobic biodegradation for up to 12 months with minimal site disturbance, no permanent or emplaced above ground equipment, piping, tanks, power sources, etc are needed. There is no operation or maintenance required. ORC Advanced provides lower costs, greater efficiency and reliability compared to engineered mechanical systems, oxygen emitters and bubblers.

ORC Advanced provides remediation practitioners with a significantly faster and highly effective means of treating petroleum contaminated sites. Petroleum hydrocarbon contamination is often associated with retail petroleum service stations resulting from leaking underground storage tanks, piping and dispensers. As a result, ORC Advanced technology and applications have been tailored around the remediation needs of the retail petroleum industry and include: tank pit excavations, amending and mixing with backfill, direct-injection, bore-hole backfill, ORC Advanced Pellets for waterless and dustless application, combined ISCO and bioremediation applications, etc.

For a list of treatable contaminants with the use of ORC Advanced, view the Range of Treatable Contaminants Guide

Chemical Composition

- Calcium hydroxide oxide
- Calcium hydroxide
- Monopotassium phosphate
- Dipotassium phosphate

Properties

- Physical state: Solid
- Form: Powder
- Odor: Odorless
- Color: White to pale yellow
- pH: 12.5 (3% suspension/water)

OXYGEN RELEASE COMPOUND

ORC Advanced® Technical Description

Storage and Handling Guidelines

Storage
Store in a cool, dry place out of direct sunlight
Store in original tightly closed container
Store in a well-ventilated place
Do not store near combustible materials
Store away from incompatible materials
Provide appropriate exhaust ventilation in places where dust is formed

Handling
Minimize dust generation and accumulation
Keep away from heat
Routine housekeeping should be instituted to ensure that dust does not accumulate on surfaces
Observe good industrial hygiene practices
Take precaution to avoid mixing with combustibles
Keep away from clothing and other combustible materials
Avoid contact with water and moisture
Avoid contact with eyes, skin, and clothing
Avoid prolonged exposure
Wear appropriate personal protective equipment

Applications

- Slurry mixture direct-push injection through hollow rods or direct-placement into boreholes
- *In situ* or *ex situ* slurry mixture into contaminated backfill or contaminated soils in general
- Slurry mixture injections in conjunction with chemical oxidants like RegenOx or PersulfOx
- Filter sock applications in groundwater for highly localized treatment
- *Ex situ* biopiles

Health and Safety

Wash thoroughly after handling. Wear protective gloves, eye protection, and face protection. Please review the ORC Advanced Safety Data Sheet for additional storage, usage, and handling requirements.

REGENESIS®

www.regenesis.com
1011 Calle Sombra, San Clemente CA 92673
949.366.8000

ATTACHMENT 2

REGENESIS APPLICATION RECOMMENDATIONS

LANGAN

REGENESIS

Project Info		
Bronx Point		
Bronx NY		
ORCA injection area		
Prepared For:		
Langan Woo Kim		
Target Treatment Zone (TTZ) Info	**Unit**	**Value**
Treatment Area	ft^2	43,500
Top Treat Depth	ft	10.0
Bot Treat Depth	ft	20.0
Vertical Treatment Interval	ft	10.0
Treatment Zone Volume	ft^3	435,000
Treatment Zone Volume	cy	16,111
Soil Type	---	sand
Porosity	cm^3/cm^3	0.33
Effective Porosity	cm^3/cm^3	0.20
Treatment Zone Pore Volume	gals	1,073,829
Treatment Zone Effective Pore Volume	gals	650,805
Fraction Organic Carbon (foc)	g/g	0.002
Soil Density	g/cm^3	1.7
Soil Density	lb/ft^3	108
Soil Weight	lbs	4.7E+07
Hydraulic Conductivity	ft/day	25.0
Hydraulic Conductivity	cm/sec	8.82E-03
Hydraulic Gradient	ft/ft	0.003
GW Velocity	ft/day	0.38
GW Velocity	ft/yr	137
Sources of Oxygen Demand	**Unit**	**Value**
Dissolved Phase Contaminant Mass	lbs	54
Sorbed Phase Contaminant Mass	lbs	185
Reduced Metals (Fe2+ and Mn2+) Mass	lbs	269
BOD mass equivalent	lbs	45
COD mass equivalent	lbs	179
Total Mass Contributing to O_2 Demand	**lbs**	**732**
Stoichiometric Demand	**Unit**	**Value**
Stoichiometric O_2 Demand	lbs	996
Stoichiometric ORC Advanced Demand	**lbs**	**5,859**
Application Dosing	**Unit**	**Value**
ORC Advanced to be Applied	**lbs**	**34,800**

ORC Advanced® Application Design Summary

ORCA injection area	
Application Method	**Direct Push**
Spacing Within Rows (ft)	**20**
Spacing Between Rows (ft)	**25**
Application Points	**90**
Areal Extent (square ft)	43,500
Top Application Depth (ft bgs)	10
Bottom Application Depth (ft bgs)	20
ORC Advanced to be Applied (lbs)	**34,800**
ORC Advanced per point (lbs)	387
Percent Slurry	**30%**
Volume Water (gals)	**9,730**
Volume ORC Advanced (gals)	1,566
Total Application Volume (gals)	**11,296**
Injection Volume per Point (gals)	126

Field App Instructions

Input special application instructions here as needed.

Field Mixing Ratios
Water per Pt (gals)
108
ORC Advanced per Pt (lbs)
387
Total Volume per Pt (gals)
126

Technical Notes/Discussion

Assumptions/Qualifications

In generating this preliminary estimate, Regenesis relied upon professional judgment and site specific information provided by others. Using this information as input, we performed calculations based upon known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to affect remediation of the site.

REGENESIS developed this Scope of Work in reliance upon the data and professional judgments provided by those whom completed the earlier environmental site assessment(s). The fees and charges associated with the Scope of Work were generated through REGENESIS' proprietary formulas and thus may not conform to billing guidelines, constraints or other limits on fees. REGENESIS does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where REGENESIS may serve as a supplier or subcontractor to an entity which seeks reimbursement from the Government for all or part of the services performed or products provided by REGENESIS, it is the sole responsibility of the entity seeking reimbursement to ensure the Scope of Work and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity which seeks reimbursement from the Government, REGENESIS does not knowingly present or cause to be presented any claim for payment to the Government.

Prepared By: Name-Title

Date: 12/17/2020